MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: Montana PROJECT NO. F-78-R-4
PROJECT TITLE: Statewide Fisheries Investigations
JOB TITLE: Northcentral Montana Warm and Coolwater Ecosystems

1997 ANNUAL REPORT

ABSTRACT

A total of 14 warm/coolwater fishery ecosystems were inventoried during the report period. Yellow perch and crayfish are the most abundant forage species at Bynum Reservoir and Lake Frances while spottail shiner are highest at Tiber Reservoir. Information is presented on retention of various tags used on walleye. Northern pike numbers continue at high levels at Lake Frances. Walleye remain stable at Bynum Reservoir and Lake Frances, while a slight increase occurred at Tiber Reservoir. Approximately five million cisco fry were stocked in Tiber Reservoir with survival documented using hydroacoustics, trawls and vertical gill nets. Year-class strength of walleye was determined for Bynum Reservoir, Lake Frances and Tiber Reservoir. Spottail shiners, introduced into Petrolia Reservoir in June 1996 and 1997, were found in very low numbers. Capture rates of all species of forage fish in Petrolia declined from 1996. Numbers of walleye gill netted declined from 1997 but yellow perch were at a record high. In East Fork Reservoir, traps caught 81 northern pike and 359 yellow perch. Two of the northern pike had been captured in 1995 and each had gained about four lbs over two years. In East Fork Reservoir, record numbers of yellow perch were seined and gill netted. Several small reservoirs were surveyed in the Lewistown area, some of which could offer new fisheries.

OBJECTIVES

1. To identify and monitor the characteristics and trends of fish populations, angler harvest and preferences, and habitat conditions in northcentral Montana warm and coolwater ecosystems.

2. Use survey and inventory information to identify management problems and opportunities, then develop and implement management actions to maintain fish populations at levels consistent with habitat conditions or other limiting factors.

3. Review projects proposed by state, federal, and local agencies and private parties which have the potential to affect fisheries resources and aquatic habitats. Provide technical advice or decisions to reduce or mitigate resource damage.

4. Provide landowners and other private parties with technical advice and information to sustain and

enhance fisheries resources and aquatic habitat.

5. Enhance public understanding and awareness of fishery and aquatic habitat resources and issues in northcentral Montana through oral and written communication.

6. Maintain and enhance public access to fishery resources in northcentral Montana.

PROCEDURES

Fish populations were sampled with a boat mounted electrofish shocker, standard 125 x 6 foot multi filament experimental gill nets (fished sinking or floating) with 25 foot sections of 0.75, 1.00, 1.25, 1.50, and 2.00 inch square mesh; 100 x 10 foot vertical gill nets(six nets of differing square mesh: 0.50, 0.75, 1.00, 1.25, 1.50 and 2.00 inch); 150 x 6 foot trammel net with 1 inch inner and 10 inch outer mesh; 3 x 4 foot frame trap nets (0.25 inch square mesh); 4 x 6 foot frame trap nets (1.00 inch square mesh); 50 x 4 foot beach seine (1/8 inch square mesh); and a 100 x 10 foot seine (0.25 inch square mesh). A hydroacoustic survey collected fish densities along equally spaced transects as suggested by Gunderson (1993). A BioSonics Model 105 Echosounder (420kHz) was used to transmit and receive signals from a dual beam system (boat mounted 6° and 15° circular transducer). Data were collected in digital format on tape and processed with a BioSonics Model 281 Echo Signal Processor. Fish densities were calculated using BioSonics ESPTS software. Captured fish were measured to the nearest tenth of an inch and weighed to the nearest hundredth of a pound. Stomach samples, and scale and fin ray/spine samples, were collected from some fish for food habits, and age and growth studies, respectively. Vertical plankton tows were made using a 30 cm conical net with a 15 cm radius (0.153 mm mesh). Walleye dorsal spines were mounted and sectioned according to methods described by Mackay et. al. (1990). A computer program designed by Liknes (1993) was used to generate age composition and estimate the number of walleye caught by age. An index of year-class strength of walleye was calculated using parameters developed by Goeman (1993). Age composition of a gill net catch was re-constructed according to Ketchen's stratified subsampling method described in Ricker (1975). Relative weight (Wr) of walleye, northern pike and yellow perch were determined using MDFWP computer programs which utilized data in Murphy et al. 1990, Willis 1989, and Willis et al. 1991. Floy T-tags were used on northern pike, while Floy T-tags, Cinch-up tags and metal jaw tags were used on walleye. White suckers were also marked with fin clips. Throughout the report, abbreviations for fish species appear in tables and figures and are explained here rather than in each instance where they appear: WE=walleye; NP=northern pike; LMB=largemouth bass; Ling=burbot; SNS=shovelnose sturgeon; Rb=rainbow trout; LL=brown trout; BBh=black bullhead; YP=yellow perch; SS=spottail shiner; ES=emerald shiner; LND=longnose dace; LC=lake chub; FHC=flathead chub; FHM= fathead minnow; SB=brook stickleback; MSc=mottled sculpin; WSu=white sucker; LnSu=longnose sucker.

FINDINGS

CHOTEAU AREA WATERS

Bynum Reservoir

A total of 27 trap net nights were fished from April 21 to 23, 1997. The traps caught a total of 620 walleye, 32 yellow perch, 5 brook trout and 1,362 white sucker. Water temperatures ranged from 42-44°F. Lengths and weights of miscellaneous species are on file in the Choteau field office.

A total of 250 walleye over 14 inches in length were tagged with Floy T-tags and metal jaw tags to help monitor exploitation. Fish were double tagged to determine which had better retention and will be discussed later in the report. These fish ranged in length from 14.0-22.5 inches and averaged 17.8 inches. Average weight was 2.16 pounds with a range of 0.91-5.43 pounds. Anglers voluntarily returned 40 tags during 1997 (Table 1). One tag was from the 1992 tagging year (not shown in Table 1) bringing the cumulative return for this year to 25.5 percent. First year returns continue to total less than 8 percent.

A total of 16 shoreline seine hauls were made on August 20, 1997, to measure abundance of forage species. Examination of Figure 1 shows a marked increase in yellow perch numbers over the previous two years while spottail shiner continue at low levels. Other species taken in 1997 are listed in Appendix I. Natural reproduction of walleye was documented once again during the 1997 surveys (Figure 2). Walleye have not been stocked in Bynum since 1992.

Ten gill nets fished during September caught 99 walleye, 2 yellow perch and 418 white sucker (Table 2). Crayfish continue to increase as 2,141 were taken in the nets. Figure 3 indicates that walleye continue at stable levels while adult yellow perch occur in the lowest numbers since 1994.

Forty stomachs of walleye taken in gill nets were examined in the field. Crayfish occurred in nearly one-half of the stomachs. Slightly over one-third of the stomachs were empty.

In cooperation with the Great Falls Chapter of Walleye Unlimited, yellow perch spawning structures were installed in Bynum Reservoir in early May. Approximately 200 single Christmas trees, 30 rings of trees (w/5 trees each), and 100 plastic Berkley "Fish Hab" units were placed at depths ranging from 15 to 20 feet.

Lake Frances

Spring netting surveys were conducted from April 22-26, 1997. Thirty-five trap net nights caught 32 walleye, 194 northern pike, 6 yellow perch, 2 ling and 20 white sucker. A total of 72 short-term gill net sets captured 217 walleye and 6 northern pike. Water temperatures ranged from 40°F during the survey. Data collected on miscellaneous species are on file in the Choteau field office.

Table 1. Angler exploitation of walleye and northern pike in Region Four reservoirs as indicated by voluntary tag returns, 1993-1997.

Lake	Species	Year tagged	Number tagged	Number of Returns (%) 1993	1994	1995	1996	1997	Cumulative
Bynum Res.	WE	1993	225	8(3.6)	9(4.0)	6(2.7)	0(0.0)	0(0.0)	23 (10.2)
		1994	483		23(4.8)	13(2.7)	0(0.0)	1(0.2)	37 (7.7)
		1995	347			26(7.5)	10(2.9)	9(2.6)	45 (13.0)
		1996	250				5(2.0)	12(4.8)	17 (6.8)
		1997	250					17(6.8)	17 (6.8)
Lake Frances	WE	1993	250	19(7.6)	7(2.8)	9(3.6)	2(0.8)	1(0.4)	38 (15.2)
		1994	242		12(4.9)	10(4.1)	3(1.2)	4(1.7)	29 (12.0)
		1995	289			17(5.9)	6(2.1)	11(3.8)	34 (11.8)
		1996	73				1(1.4)	2(2.7)	3 (4.1)
		1997	226					7(3.1)	7 (3.1)
	NP	1993	76	3(3.9)	4(5.3)	0(0.0)	2(2.6)	0(0.0)	9 (11.8)
		1994	310		17(5.4)	9(2.9)	4(1.3)	1(0.3)	31 (10.0)
		1995	325			26(8.0)	13(4.0)	2(0.6)	41 (12.6)
		1996	46				6(13.0)	3(6.5)	9 (19.6)
		1997	155					7(4.5)	7 (4.5)
Tiber Res.	WE	1993	398	35(8.8)	26(6.5)	16(4.0)	2(0.5)	0(0.0)	79 (19.8)
		1994	461		48(10.2)	14(3.0)	7(1.5)	1(0.2)	70 (15.2)
		1995	500			63(12.6)	18(3.6)	13(2.6)	94 (18.8)
		1996	499				40(8.0)	26(5.2)	66 (13.2)
		1997	499					39(7.8)	39 (7.8)
	NP	1993	225	21(9.3)	11(4.8)	5(2.2)	2(0.9)	0(0.0)	39 (17.3)
		1994	153		25(16.3)	0(0.0)	1(0.7)	1(0.7)	27 (17.6)
		1995	182			14(7.7)	7(3.8)	1(0.5)	22 (12.1)
		1996	250				26(10.4)	8(3.2)	34 (13.6)
		1997	79					13(16.5)	13 (16.5)

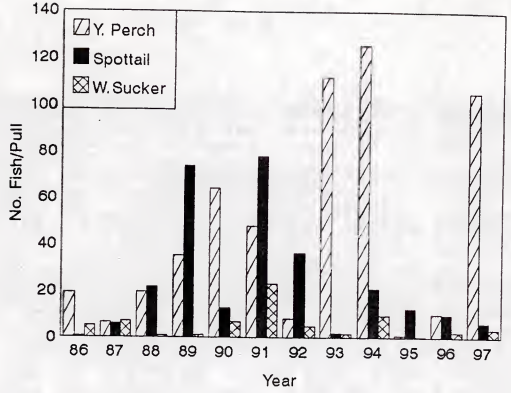

Figure 1. Forage fish trends in Bynum Reservoir, 1986-1997.

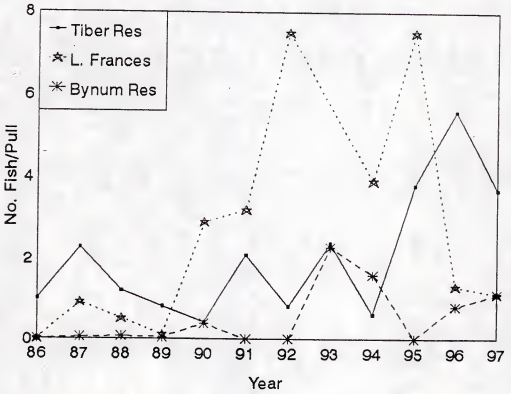

Figure 2. Reproduction of walleye in three reservoirs (1986-97).

Table 2. Overnight gill netting results in warm and cool water reservoirs in the western portion of Region Four, 1997.

Water (date sampled)	Surface acres 1/	No. of nets 2/	Mean hrs. per net	Species	No. of fish	Length range	(avg)	Weight range	(avg)
Bynum Reservoir (9/16-17/97)	3,000	10 S	16.6	WE	24	7.7-12.8	(10.0)	0.10- 0.57	(0.32)
					11	13.0-15.5	(14.6)	0.62- 1.30	(1.02)
					57	16.0-19.9	(18.2)	1.28- 3.18	(2.20)
					7	20.2-24.8	(21.5)	2.96- 4.60	(3.39)
				YP	2	5.5- 5.8	(5.7)	0.06- 0.08	(0.07)
				WSu	93	6.8-11.8	(10.4)	0.12- 0.88	(0.57)
					325	14.0-19.0	(15.8)	1.22- 3.20	(1.79)
Lake Frances (9/9-10/97)	5,000	20 S	18.3	WE	13	7.5-12.9	(10.8)	0.11- 0.81	(0.41)
					43	13.2-15.8	(13.9)	0.64- 1.22	(0.87)
					24	16.1-19.5	(18.0)	1.30- 2.49	(1.93)
					3	20.4-25.1	(22.1)	2.83- 5.01	(3.63)
				NP	29	9.2-15.6	(13.5)	0.16- 0.87	(0.56)
					40	16.4-19.8	(18.2)	0.87- 2.28	(1.34)
					18	20.1-33.2	(23.4)	1.56- 8.40	(3.05)
				YP	130	5.7- 8.9	(7.1)	0.13- 0.45	(0.22)
					121	9.0-10.9	(9.8)	0.36- 0.91	(0.55)
					13	11.0-12.6	(11.7)	0.83- 1.26	(0.98)
				WSu	6	16.2-19.5	(18.4)	2.10- 3.22	(2.79)
Tiber Reservoir (9/3-5/97)	17,300	29 S	17.2	WE	53	6.3-12.9	(10.1)	0.08- 0.70	(0.35)
					42	13.0-15.3	(14.1)	0.72- 1.36	(0.94)
					13	16.0-19.0	(17.1)	1.30- 2.02	(1.67)
					1		(20.0)		(2.50)
				NP	6	9.7-12.6	(11.0)	0.18- 0.44	(0.32)
					2	16.5-19.5	(18.0)	1.14- 1.88	(1.51)
					10	20.2-25.6	(21.8)	1.97- 4.74	(2.75)
				YP	183	5.2- 8.9	(7.0)	0.07- 0.37	(0.18)
					51	9.0-10.8	(9.6)	0.34- 0.66	(0.45)
					5	11.4-13.2	(12.1)	0.70- 1.10	(0.86)
				WSu	20	6.4-12.8	(9.3)	0.12- 1.02	(0.42)
					47	13.3-18.8	(16.7)	1.00- 3.00	(2.09)
				LnSu	1		(10.2)		(0.43)
					11	13.2-19.9	(16.1)	0.86- 3.06	(1.78)
				Carp	27	3.8- 5.5	(4.4)	0.03- 0.12	(0.06)
					1		(9.5)		(0.49)
					3	26.1-28.0	(27.1)	8.80-12.40	(11.20)
				Rb	3	13.4-15.0	(14.4)	0.92- 1.28	(1.14)
					8	18.1-22.1	(19.8)	1.95- 3.19	(2.47)
				Ling	1		(14.1)		(0.68)

1/ Approximate surface acres at time of survey.
2/ S = Sinking gill net.

A total of 226 walleye over 14 inches were tagged with metal jaw tags. These fish averaged 18.1 inches and 1.91 pounds (length range 14.0-23.2; weight range 0.82-4.96). A total of 155 northern pike over 16 inches were marked with Floy t-tags. They averaged 18.9 inches and 1.58 pounds (length range 15.7-27.6; weight range 0.78-5.45).

During the report period, anglers returned 25 tags from walleye and 13 tags from northern pike, representing fish tagged back through 1993 (Table 1). First year returns for walleye range from 1.4 to 7.6 percent while northern pike range from 3.9 to 13 percent. Maximum cumulative returns is about 15 percent for walleye and 20 percent for northern pike.

A total of 17 seine hauls were made on August 19, 1997, to sample forage fish along shoreline areas. Yellow perch were most abundant followed by spottail shiner (Appendix I). These two species are the main forage fish in Lake Frances but show considerable decline over the previous year (Figure 4). Other species taken during seining include young-of-the-year northern pike and walleye, along with white sucker, burbot and crayfish. Walleye reproduction since 1986 is plotted in Figure 2.

The September gill net survey captured 264 yellow perch in 20 nets, along with 87 northern pike, 83 walleye and 6 white sucker (Table 2). Perch numbers increased in 1997 and appear to be on a gradual increase (Figure 5). Northern pike decreased slightly from the 1996 netting but continue to occur at levels equal to or higher than found in any time period during the 1980's. Walleye taken during this survey are similar to 1996 but the overall population remains less than desirable. The gill nets also collected 778 crayfish, up from 503 taken during 1996.

A total of 40 stomachs from walleye were examined in the field. Approximately one third were empty while another one third contained crayfish. Other items found in decreasing order of abundance include unidentified fish remains, yellow perch, vegetation, northern pike, tapeworms and aquatic insects. Forty-six northern pike stomachs were also examined. A total of 54 percent of the stomachs contained crayfish, 26 percent had fish remains and 22 percent were empty. Other items include fish hooks, rocks, burbot and walleye.

Pishkun Reservoir

Shoreline seining in August collected the following forage species in decreasing order of abundance: yellow perch, white sucker, crayfish and spottail shiner (Appendix I). Young-of-the-year northern pike were also taken. Gill netting results for Pishkun Reservoir appear in the annual coldwater lakes report (Tews, et al, 1998).

Tiber Reservoir

Trap nets were fished in the upper portion of Tiber Reservoir in the Devon area while the Marias River above the reservoir was electrofished from April 7-17, 1997. Both types of sampling gear were also employed in the Willow Creek Arm (WCA) from April 18-19, 1997. Water temperatures ranged from 38-47°F in the Devon and Marias River areas and 48-50°F in the WCA. Water levels remained fairly stable during the surveys at 2983.4 feet M.S.L. and inflows varied from 650-1150 cfs.

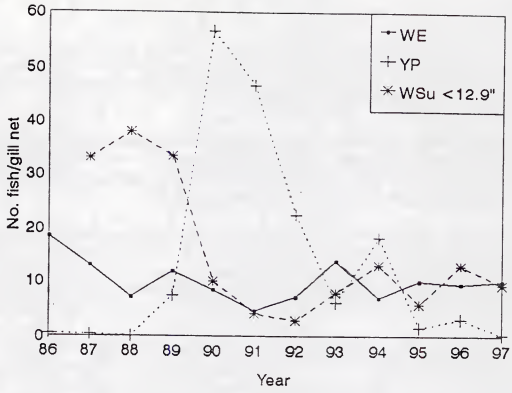

Figure 3. Trends of the fish populations in Bynum Res. (fall gill nets 1986-97).

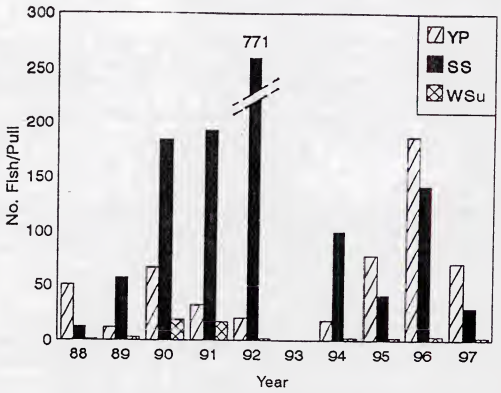

Figure 4. Forage fish trends in Lake Frances, 1988-1997.

A total of 66 trap net nights in the Devon area caught 61 walleye, 62 northern pike, 36 rainbow trout, 7 yellow perch, 14 white sucker, 20 carp, 38 burbot, 53 longnose sucker and 1 flathead chub. In the Marias River, approximately five miles of stream were electrofished over a five-day period. Eighteen hours were expended and captured a total of 375 walleye, 6 northern pike and 39 rainbow trout. Other species taken while shocking include burbot, carp, white sucker, longnose sucker, flathead chub and mountain whitefish.

In the WCA, 20 trap net nights captured 22 walleye, 26 northern pike, 5 rainbow trout, 10 yellow perch, 53 white sucker, 29 burbot, 5 longnose sucker, and 5 carp. Electrofishing of the upper portion of the WCA over a two-day period (6.5 hours) produced 228 walleye and 5 northern pike. Other species taken while shocking include rainbow trout, yellow perch, white sucker, longnose sucker, and burbot.

During spring investigations, a total of 499 walleye (> 14 inches), 79 northern pike (>16 inches) and 80 rainbow trout were tagged and released. In the Devon/Marias area, 275 walleye averaged 16.7 inches (range 14.0-32.9) and 1.60 pounds (range 0.69-13.80). A total of 58 northern pike averaged 21.4 inches (range 18.2-28.9) and 2.93 pounds (range 1.32-7.20). In the WCA, 225 walleye averaged 17.6 inches (range 14.0-23.6) and 1.79 pounds (range 0.78-4.10). Twenty-one northern pike in the WCA averaged 21.8 inches (range 16.0-30.0) and 3.04 pounds (range 0.86-9.00). Rainbow trout averaged 18.5 inches (range 13.0-21.9) and 2.25 pounds (range 0.81-3.90). Lengths and weights of the miscellaneous species taken in both areas are on file in the Choteau field office.

Anglers voluntarily returned tags from 79 walleye, 23 northern pike and 5 rainbow trout harvested during the report period (Table 1). First-year returns for walleye tagged since 1993 ranges from about 8-12 percent while first-year returns for northern pike varies from about 8-16 percent. Cumulative returns for both species in some years are approaching 18-20 percent. Movement of walleye following tagging is greater from the Devon/Marias area than from the WCA. Walleye tagged in the upper portion of the reservoir are caught uniformly throughout the reservoir whereas the majority of those tagged in the WCA are also caught in the WCA. Most of the northern pike are caught in the same area as in which they were tagged.

Three small mesh trap nets fished overnight on June 9-10,1997, caught an estimated 9-10,000 spottail shiner. Approximately 2,000 adult spottail were transferred to Bynum Reservoir on June 10, and another 2,000 adult spottail were transferred to Petrolia Reservoir on June 11.

Fourteen species were collected in 68 seine hauls along shoreline areas throughout the reservoir from August 25-28, 1997. Appendix I shows that spottail shiner and yellow perch were found in greatest numbers. Examination of Figure 6 shows spottail shiner populations have been stable for the past four years while yellow perch numbers in 1997 increased over the previous year. Emerald shiner occur at very low levels. During the survey, the reservoir level was approximately 2993 feet M.S.L. and water temperatures varied from 69-72°F. For the third consecutive year, good numbers of walleye were collected during seining operations (Figure 2). As in past years, most of the walleye were taken near the upper end of the reservoir.

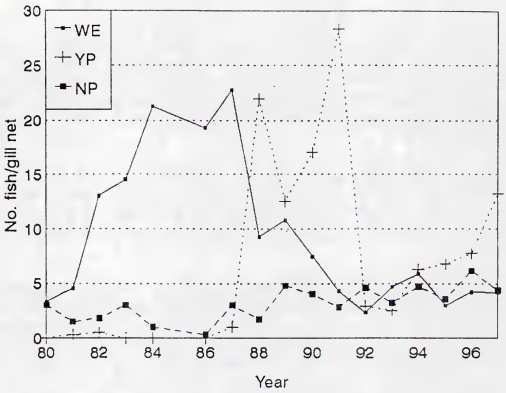

Figure 5. Trends in the fish populations in Lake Frances, (fall gill nets, 1980-1997).

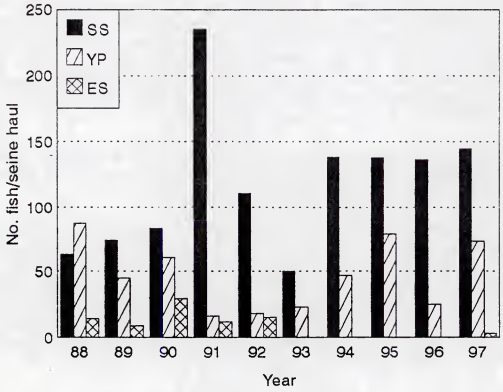

Figure 6. Forage fish trends in Tiber Reservoir, 1988-1997.

Twenty-nine sinking gill nets were fished overnight in four areas of the reservoir from September 3-5, 1997. Yellow perch and walleye were most abundant, with six other species taken in lesser numbers (Table 2). As found in 1996, the majority of the walleye are less than 16 inches in length. Trends in the fish populations shown in Figure 7 indicates that yellow perch increased dramatically while walleye increased slightly over numbers taken in 1996. Northern pike and white sucker both decreased from the previous year.

As reported in a previous report (Hill, et al, 1997), approximately five million cisco fry were introduced into Tiber Reservoir in April and May of 1997 to provide additional forage for walleye and other predators. To monitor cisco survival, vertical gill nets, trawl samples and hydroacoustic data were collected. The hydroacoustic survey was used to estimate total fish abundance in the limnetic zone of the reservoir. Vertical gill nets and trawl samples were used to partition fish targets tracked by the hydroacoustic gear. The combined effort allowed estimation of total cisco abundance.

The hydroacoustic survey was completed between 2200 and 0500 September 1-2, 1997. Fish densities were collected along 18 equally spaced transects. Transect locations and associated GPS coordinates are reported in Figure 8 and Table 3, respectively. Fish targets were partitioned by species using vertical gill net samples collected in three areas of the reservoir (Figure 8).

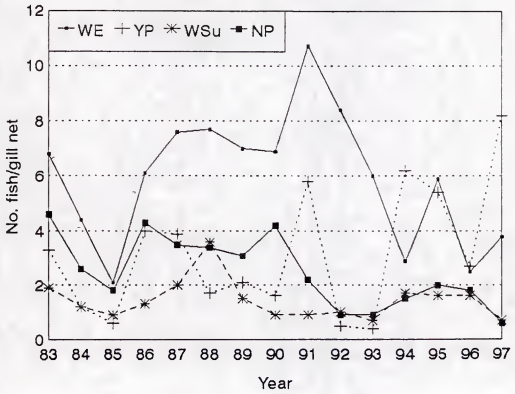

Figure 7. Trends in the fish populations in Tiber Res. (fall gill nets, 1983-97).

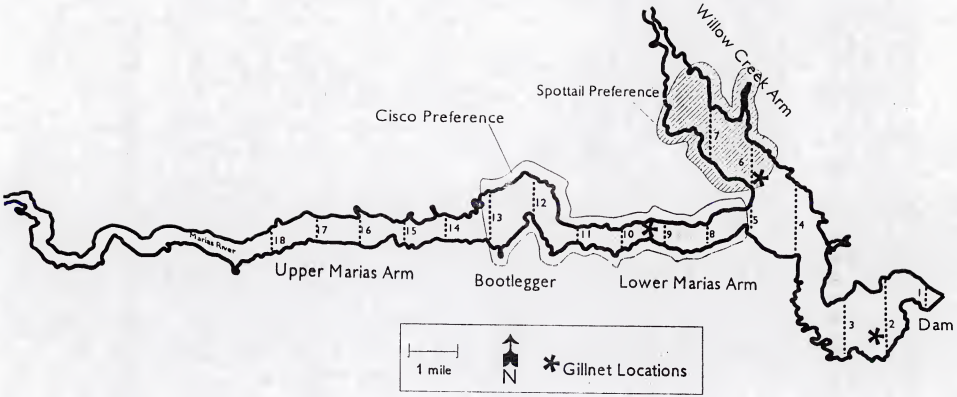

Figure 8. Map of Tiber Reservoir with hydroacoustic transects and vertical gill net locations.

Table 3. Transect location, estimated transect length, and hydroacoustic estimates of fish densities in Tiber Reservoir.

Transect	Begin Location (GPS)	Transect Length (m)	1996 fish /1000m^3	1997 fish / 1000 m^3
1	48°19.19 N 111°06.70 W	805	0.36	0.43
2	48°21.50 N 111°10.16 W	2,961	0.40	0.50
3	48°18.48 N 111°08.03 W	2,511	0.21	0.32
4	48°18.94 N 111°08.77 W	1,352	0.92	0.42
5	48°20.05 N 111°10.18 W	1,465	0.26	1.03
6	48°20.77 N 111°12.49 W	1,561	3.32	0.97
7	48°22.61 N 111°12.76 W	2,510	8.47	2.23
8	48°20.99 N 111°12.65 W	1,110	0.32	1.93
9	48°20.27 N 111°13.94 W	901	0.31	2.19
10	48°20.68 N 111°15.33 W	805	0.47	1.83
11	48°20.61 N 111°16.17 W	547	excluded	excluded
12	48°20.98 N 111°17.55 W	1,561	0.97	0.52
13	48°20.51 N 111°18.84 W	2,011	0.20	1.32
14	48°20.49 N 111°20.40 W	853	0.87	2.30
15	48°20.50 N 111°21.68 W	901	1.27	0.97
16	48°20.48 N 111°22.94 W	1014	2.32	0.51
17	48°20.73 N 111°24.05 W	853	1.30	1.39
18	48°20.43 N 111°25.36 W	853	5.43	2.22
	means	1,365	1.61	1.24

The hydroacoustic estimate of cisco abundance was 875,000 (cisco population = total limnetic abundance 1.215 million * cisco portion of limnetic fish population based on vertical gill nets 72 percent). The estimate suggests that nearly 18 percent of the introduced cisco survived their first summer in Tiber Reservoir (875,000/5,000,000).

Cisco were most abundant in the area of the reservoir from the Bootlegger area downstream to the confluence with the WCA and selected water depths greater than 20 meters. The highlighted region on Figure 8 shows the area of the reservoir where cisco were concentrated. The vertical distribution of cisco is shown in Figures 9-13. In the Lower Marias area, most of the cisco were tracked in open water and at depths greater than 20 meters. The few fish that were tracked in shallow water were concentrated in the littoral zone, and were probably not cisco (see transect 9 on Figure 10).

A series of six vertical gill nets (each with different mesh size) were fished at three locations in early September. Young-of-the-year cisco were all collected in the ½ inch mesh net, and were taken at all three locations. Cisco made up 100, 68, and 7 percent of the catch in the Bootlegger, Dam, and WCA, respectively. Also, in the Bootlegger and Lower Marias area, trawl samples were 100 percent cisco. Therefore, it is reasonable to assume that most of the fish shown on the echograms from transects 5, 8, 9, 10, 12, and 13 were cisco (Figures 10 and 11). The netting results also indicated that spottail shiner and cisco abundance were inversely related. Spottail shiner made up 86 percent of the gill net catch in the WCA and 0 percent in the Bootlegger. The gill net sample and the fish size information from the hydroacoustic survey indicated that larger fish such as walleye and rainbow trout were not common in the open water areas of the reservoir. Cisco were in good physical condition, averaging 4.5 inches (range 4.2-4.9). Examination of Table 4 shows the numbers and depth range at which cisco were captured along with adult spottail shiner. Three rainbow trout and one walleye were also taken in the ¾ and 2 inch mesh nets.

Despite the introduction of about 5,000,000 cisco, the estimate of Tiber's overall limnetic fish population declined from 1996. The total of non-cisco targets in the reservoir dropped from 1.480,000 in 1996 to 340,000 in 1997. Mean fish densities also declined from 1.61 fish/1000m^3 to 1.24 fish/1000m^3 (Table 5). The decline resulted from fewer observations of fish above the thermocline. In 1996, fish abundance in the top 11 meters of the water column was about 1,000,000 and represented 37 percent of the total population estimate (Table 5). In 1997, total fish abundance in the top 11 meters was only 230,000 and made up 16.1 percent of the total population estimates. Conversely, total fish abundance below the thermocline (fish ≥ 20 meters deep) was 313,000 in 1997 compared to 92,000 in 1996. The increase in meta and hypolimnetic targets can be directly attributed to the addition of cisco.

Figures 9 through 13 show the density, depth, and size of fish tracked by the hydroacoustic system for all 18 transects. Each circle represents a different fish. The larger the circle the bigger the fish. The relative size of each fish (circle) can be estimated using the conversion scales at the bottom of each figure. In general, most of the fish tracked by the hydroacoustic system were between 3 and 5 inches, which correlates well with the mean size of cisco sampled in vertical gill nets and trawl samples (mean=4.5 inches). Each figure shows both 1996 (graphs on the left) and 1997 (graphs on the right) data. For example, for transect 9 on Figure 10, the number of circles shown is much

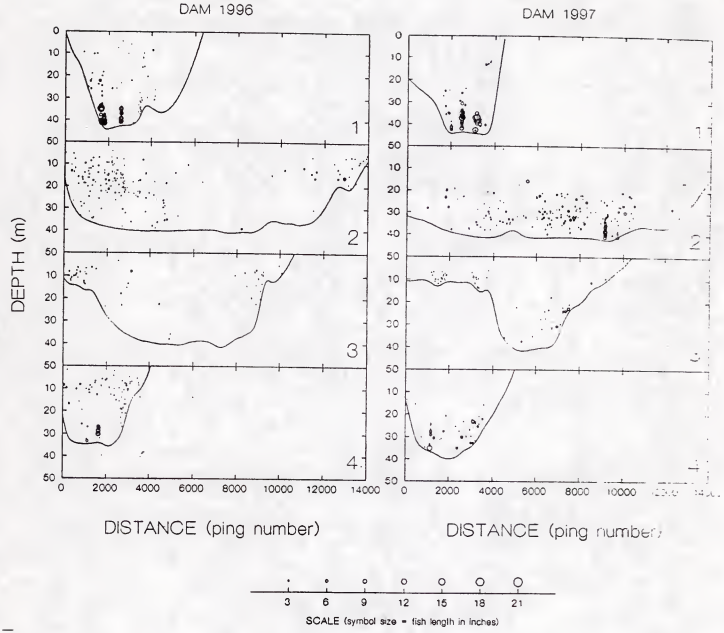

Figure 9. Echograms for transects 1-4.

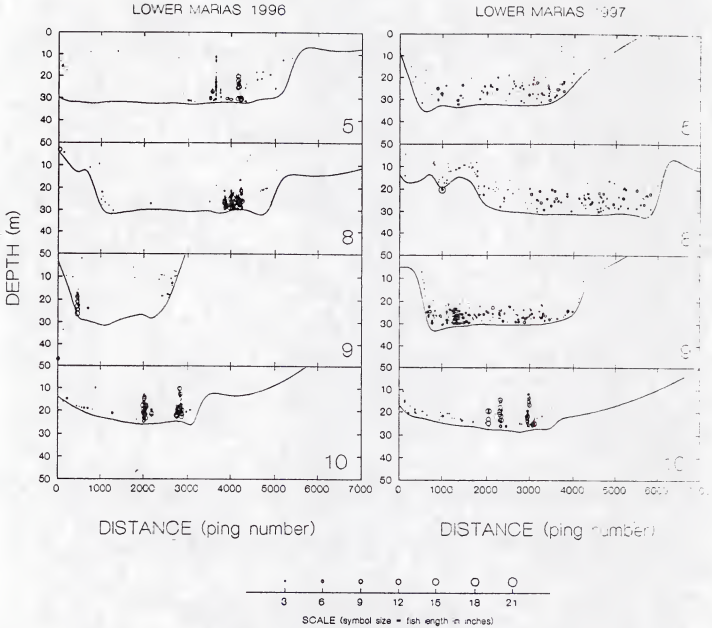

Figure 10. Echograms for transects 5, 8, 9, and 10.

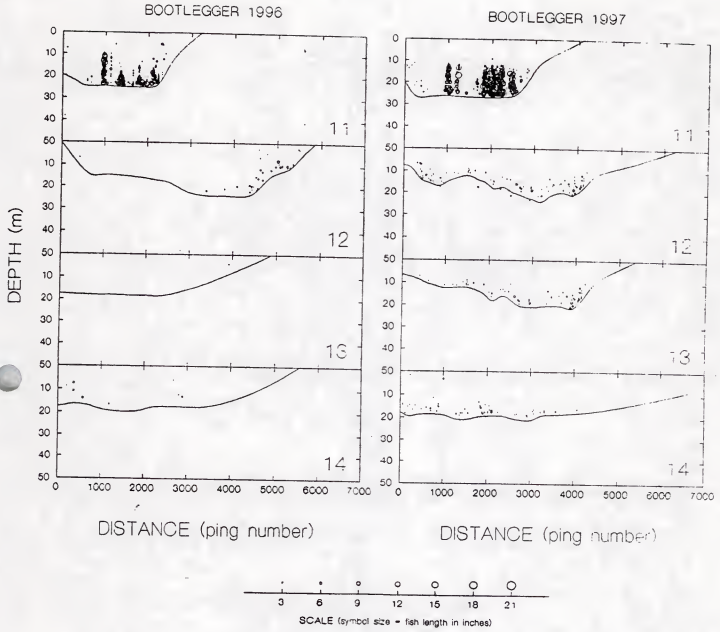

Figure 11. Echograms for transects 11-14.

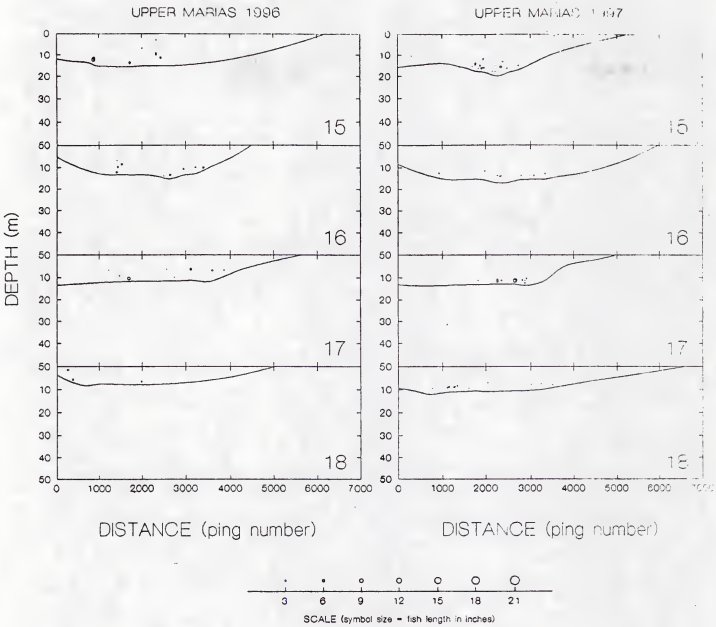

Figure 12. Echograms for transects 15, 16, 17, and 18.

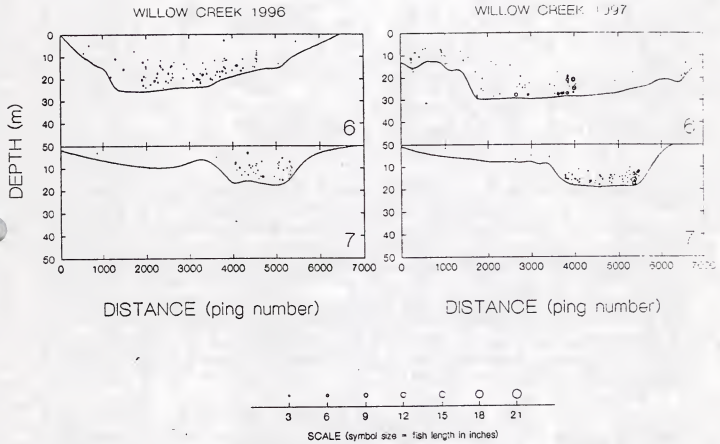

Figure 13. Echograms for transects 6 and 7.

Table 4. Vertical gill net results from three areas of Tiber Reservoir, 1997 (1/2" mesh, 10' wide, 100' deep).

	No. fish* caught by area					
	WCA		DAM		BT	
Depth range:	CIS	SS	CIS	SS	CIS	SS
0- 25'	0	3	0	0	6	0
26- 50'	1	13	4	4	16	0
51- 75'	1	8	8	1	35	0
76-100'	0	0	5	1	11	0
DATE	9/3/97		9/4/97		9/5/97	
Max depth	96'		118'		105'	

* Abbreviations: CIS = cisco; SS = spottail shiner

greater on the right than left. Thus, for transect 9, we observed a lot more fish in 1997 compared to 1996. Also, the same two graphs suggest a tendency for fish to be deeper in 1997. As for fish size comparisons, there were too few fish observed in 1996 to say much, but a good smattering of fish between 3 and 6 inches were recorded in 1997. It is important to note, however, that the echograms include noise from trees. Trees appear as vertical lines of circles. There are several examples of trees shown on Figure 10. A good example is the vertical line of circles on the left side of transect 9 from the 1996 survey. There were also trees observed along transect 5, 8, and 10, from the 1996 survey. For unknown reasons, there appeared to be more tree problems associated with the 1996 survey. To avoid tree bias, an attempt was made to remove the trees from the analysis. However, deciding which targets to remove was a subjective process. Data from transect 11 was so convoluted by trees that it was dropped from analysis (see Figure 11).

It is also important to note, that the echograms appear to contradict the fact that the overall population estimate declined from 1996. Figures 9-13 clearly show more fish in 1997 (especially transects 8 and 9). In fact, there are three times as many circles (fish) shown on the echograms from 1997 compared to 1996. The contradiction can be explained by the average depth at which fish were tracked. On average, fish were much deeper in 1997 compared to 1996. Fish depth is important because the overall population estimates are based on expanding mean fish densities in 10 different depth strata by the total volume of water in those same strata (see Table 5). Because there is a lot more total water in the top 5 meters of a reservoir compared to the bottom 5 meters, a fish at 5 meters is expanded by a much greater value than a fish in deeper water. The above example illustrates the major difference between the 1996 and 1997 surveys. As observed on the echograms, we tracked more fish in 1997, but on average they were in deeper water and expanded by smaller values than the shallower fish recorded in 1996 (Table 5).

Table 5. Total fish population estimates for 1996 and 1997. Fish abundance below the thermocline and number of fish per acre have also been included.

Year	depth (m)	mean density (fish / m^3)	s.d. (fish / m^3)	lake volume (m^3)	number of fish	% of total
	1-6	1.96e-03	2.32e-03	281,164,432	552,434	37.3
	6-11	1.96e-03	2.70e-03	228,196,216	447,005	30.2
	11-16	1.57e-03	2.21e-03	164,356,460	258,106	17.4
	16-21	9.70e-04	1.26e-03	135,292,058	130,592	8.8
	21-26	5.80e-04	4.30e-04	94,347,938	54,980	3.7
	26-31	3.30e-04	3.30e-04	68,599,294	22,365	1.5
	31-36	1.80e-04	1.60e-04	46,825,364	8,519	0.6
	36-41	2.30e-04	2.70e-04	21,079,188	4,788	0.3
	41-46	1.40e-04	2.00e-04	6,817,850	970	0.1
	41-50	1.30e-04	1.90e-04	667,594	87	0.0
1996			total fish		1,479,846	100
			total fish below the thermocline		91,710	
			fish/acre		105	
	1-6	6.30e-04	6.30e-04	308,815,904	195,789	16.1
	6-11	9.60e-04	1.02e-03	251,431,202	241,757	19.9
	11-16	1.53e-03	1.58e-03	180,916,740	276,937	22.8
	16-21	1.23e-03	1.32e-03	148,833,974	182,391	15.0
	21-26	2.00e-03	2.16e-03	105,883,370	211,749	17.4
	26-31	1.01e-03	1.11e-03	77,226,188	77,878	6.4
	31-36	3.60e-04	2.90e-04	56,787,446	20,371	1.7
	36-41	2.60e-04	1.60e-04	29,032,318	7,604	0.6
	41-46	6.70e-05	1.70e-05	10,709,886	716	0.1
	46-50	0	0	2,122,480	0	0.0
1997			total fish		1,215,192	100
			total fish below the thermocline		318,318	
			fish/acre		71	

To measure whether or not cisco are being utilized, walleye stomachs were collected throughout the summer during the weekend creel census and also during the fall gill netting survey. Under field conditions, it was determined that approximately 62 percent of the walleye stomachs contained food items during the summer creel (May-August). The gill net survey in early September indicated that 81 percent of the walleye stomachs had food in them. Stomach contents analyzed under compound microscopes revealed the presence of eight species of fish along with various aquatic insects and crustaceans (Table 6). Aquatic insects, including mayfly and midges, were important food items during June and July. Spottail shiner were most commonly taken during August and September while yellow perch were preferred in July and September. Young-of-the-year carp were heavily utilized in September. Due to decomposition, unidentified fish made up a large percentage of the occurrence throughout the summer. Only one cisco was positively identified from a walleye stomach. Prior to ice-over, anglers reported catching walleye with cisco in their stomachs. Two cisco were positively identified, taken from a stomach of a burbot caught in the Marias River below Tiber Dam.

Fifteen stomachs were collected from cisco captured in vertical gill nets at the Dam netting station in September. About ¼ of the stomachs contained food. Daphnia were the most common item identified with a few copepods also observed.

Temperature profiles and plankton tows were taken mid-month from May through September. Maximum surface temperatures was 68°F in July and 72°F in August. Temperatures at 80 feet reached 60°F in August and 66°F in September.

Tiber Reservoir zooplankton samples were collected at a permanent buoy anchored in approximately 130 feet of water in the middle of the reservoir approximately 1.5 miles upstream from the dam. Duplicate 50-foot vertical tows were made on each sample date using a 30-cm diameter conical plankton net (1 meter long) with 153 micron mesh. Samples were pooled in the field and preserved with 95% ethanol. Pooled samples were diluted in the laboratory and three 1 ml subsamples were withdrawn with a Hensen-Stempel pipette and enumerated separately using either a compound microscope at 40X or a microfiche reader at 62X total magnification. The first 50 or more crustacean zooplankters encountered (excluding copepod nauplii and ejected cladoceran embryos) were measured to the nearest .02 mm using a microfiche reader at 62X magnification to compute average length of all crustaceans. Additional daphnids, cyclopoid copepods, and calanoid copepods were measured to ensure at least 20 individuals within each taxonomic group were measured whenever possible. Daphnids were measured from the tip of the head to the base of the terminal spine and copepods were measured from the tip of the head to the end of the abdomen at the point of insertion of caudal rami.

Crustacean zooplankton samples were collected on Tiber Reservoir once monthly during May through September in 1996 and 1997 and twice monthly in 1991 to document existing populations and monitor the potential effects of cisco introduced for the first time in spring 1997. Plankton density averaged approximately 10 organisms per liter during the three-year period (Table 7), which is considerably less than the average of around 27/L on Fort Peck Reservoir for similar months during 1989 and 1990 (Mullins 1991). Due to their large size, *Daphnia* are typically a preferred food of

Table 6. Stomach analysis of walleye and northern pike from Tiber Reservoir, 1997.* (Frequency of occurrence.

	Walleye				Northern Pike	
	June	July	August	Sept	May/June	Sept
No. stomachs	37	9	28	45	8	10
No. empty	5	0	2	1	1	0
Item-(frequency of occurrence)						
Unid. fish	10.8	44.4	36.7	28.8	0	20.0
Spottail shiner	10.8	0	20.0	22.2	66.7	10.0
Yellow perch	0	22.2	3.3	20.0	0	0
Carp	2.7	0	26.7	55.5	0	40.0
Cisco	0	0	0	2.2	0	0
Walleye	0	0	0	2.2	0	20.0
Northern pike	0	0	3.3	0	0	0
Sucker	0	0	0	2.2	0	0
Crayfish	5.4	11.1	35.7	4.4	37.5	10.0
Mayfly	29.7	44.4	20.0	2.2	0	10.0
Midge larva pupae	59.5	33.3	6.7	6.6	16.7	0
Misc. aquatic insects	21.6	22.2	26.7	2.2	16.7	10.0
Freshwater shrimp	21.6	22.2	0	0	16.7	0
Daphnia	8.1	0	0	0	0	0
Vegetation/debris	13.5	0	20.0	22.2	33.3	50.0

* May through August samples - creel census
September samples - gill nets

Table 7. Average density (number per liter) and length (millimeters) of crustacean zooplankton captured in duplicate 50-foot vertical tows at a mid-reservoir station on Tiber Reservoir during May through September 1991-1997.

Year	No. of samples	Daphnia		Cyclopoid copepods		Calanoid copepods		All crustaceans	
		# per liter	Ave. length (mm)	# per liter	Ave. length (mm)	# per liter	Ave. length (mm)	# per liter	Ave. length (mm)
1991	10	1.87	1.34	2.94	0.71	3.07	1.11	7.88	1.04
1996	5	3.81	1.28	4.34	0.62	4.04	0.99	12.20	0.89
1997	5	1.73	1.37	4.91	0.59	3.53	1.00	10.18	0.89

planktivorous fish in western reservoirs. Mullins (1991) observed cisco in Fort Peck fed selectively on *Daphnia* and this organism comprised 92% of the zooplankton found in a small sample of cisco stomachs from Tiber in September 1997. The density of *Daphnia* in Tiber during 1997 was lower than 1996 but similar to 1991 (Table 7). The average size of *Daphnia* was similar between years, indicating cisco had little effect during their first year of residence in Tiber. Average length of all crustaceans was identical in 1996 and 1997 though somewhat lower than 1991 due to the larger average size of copepods in 1991.

Participation in the Marias Management Committee continued as discussions were held with the Bureau of Reclamation to manage water elevations for the benefit of the fishery.

Creel Census

For the fifth consecutive year, weekend creel censuses were conducted at Tiber Reservoir and Lake Frances from Memorial Day through Labor Day. The data are presented in a separate document (Hill, 1998).

Tag Loss

A previous report (Hill, et al. 1997) described the various types of tags used on walleye over the past twenty years and tag loss associated with each. This report will provide spring trapping data from 1997 and 1998 to supplement information reported earlier.

In 1993 and 1994 at Bynum Reservoir, a total of 416 walleye were tagged with T-tags (and a right pelvic fin clip) and 292 were tagged with cinch-up tags (and a left pelvic fin clip). Data collected over the past two years for these tagged fish show that loss of T-tags remained about the same in 1997 as 1996 (92 percent compared to 93 percent) but increased to 100 percent loss in 1998. Using 1997 trapping data, loss on cinch-up tags was 46 percent and is comparable to earlier years but with 1998 trapping data, loss increased to 80 percent.

In 1996, 250 walleye at Bynum Reservoir were tagged with metal jaw tags only and were not additionally marked with a fin clip. Spring trapping in 1997 showed zero tag loss of 20 jaw tagged fish observed. This group of fish can not be followed in future years due to the single marking scheme.

A total of 250 walleye were double tagged with metal jaw tags and T-tags in 1997 at Bynum Reservoir. The following spring (1998), no loss of jaw tags was observed. Three of 17 T-tags were lost for a loss of 18 percent.

At Tiber Reservoir in 1995, 500 walleye were double tagged with T-tags and cinch-up tags. Information collected in the spring of 1997 show no additional tag loss for T-tags but 8 of 16 fish had loss of cinch-up tags for 50 percent loss. In 1998, loss of T-tags for this group of fish remained low, at 8 percent (1 of 13 losing tags). Thirteen of 13 cinch-up tags were lost for 100 percent loss.

A total of 499 walleye were double tagged with metal jaw tags and cinch-up tags in Tiber Reservoir in 1996. Spring trapping operations in 1997 and 1998 showed 1 of 20 (5 percent) losing jaw tags over the first year and increased to 13 percent (1 of 8 losing jaw tags) at the end of the second year. Cinch-up tag loss was higher, 2 of 20 losing tags (10 percent) over the first year, increasing to 3 of 8 losing tags (38 percent) at the end of the second year.

At Tiber Reservoir in 1997, 499 walleye were again double tagged with metal jaw tags and cinch-up tags. Spring trap nets in 1998 showed zero tag loss (0 of 17 losing tags) for jaw tags at the end of the first year. Loss of cinch-up tags was 29 percent (5 of 17 losing tags) for the same time period.

Newman and Hoff (1998) reported that walleye in Escanaba Lake, Wisconsin, had an average annual tag loss for jaw tags at the rate of nearly 28 percent for fish recaptured in fyke nets. This is considerably higher than that found at either Bynum Reservoir or Tiber Reservoir. According to Yerk, 1997 (pers. comm), jaw tags placed on walleye in Holter Reservoir showed zero tag loss after one year. The Wisconsin study placed the tag on the maxillary whereas the Montana studies utilize the mandible for fish less than 20 inches and the maxillary on fish larger than 20 inches.

Anglers occasionally complain about red sores on fish that are tagged. During 1997 and 1998 spring trapping operations, observations were made of tagged fish. These include 88 jaw tags, 67 T-tags, and 52 cinch-up tags. Appearance of the flesh at and around the point of tag insertion was rated as good, slight abrasion, or raw. Sixty-eight percent of the jaw tags were rated as good and 7 percent as raw. Cinch-up tags produced the highest rate of raw condition at 40 percent. T-tags were rated as 54 percent good and 12 percent raw conditions.

Age and Growth

Walleye from Bynum Reservoir, Lake Frances and Tiber Reservoir have been aged by analyzing dorsal spine sections since 1991. Age composition for walleye taken in fall gill nets is presented in Appendixes III-V. Two and three year old walleye at Bynum Reservoir and Lake Frances comprise about 39 percent of the population, while 52 percent of the walleye at Tiber Reservoir fall into this same age classification.

Year-class strength for walleye from all three reservoirs was calculated. The index is based on values averaging near 100. Data presented in Table 8 suggest strong year classes occurred in 1990 and 1991 for Bynum Reservoir. A fairly strong year class appears to have established in 1994. Although not shown in Table 8, preliminary data indicates that 1995 may also be fairly good. At Lake Frances, strong year classes occurred in 1985, 1986, 1988, 1989 and 1990. As at Bynum Reservoir, a fairly strong year class is apparent in 1994. Strong year classes for Tiber Reservoir developed in every year from 1985 to 1990. Walleye have not been stocked in either Lake Frances or Tiber Reservoir since populations became established in the 1970's, whereas stocking in Bynum Reservoir has not occurred since 1992.

Relative weight

Average relative weights of walleye collected in fall gill nets from three area reservoirs from 1991-1997 is presented in Table 9. As previously reported (Hill, et al, 1997), average relative weights (Wr) should range between 95-105 as suggested by Murphy. Examination of Table 9 shows that Lake Frances and Tiber Reservoir fall below the suggested range for all years presented while Bynum Reservoir averages near the lower end of the scale.

Table 8. Walleye year-class strength from three Region Four reservoirs (1991-97 fall gill nets).

Year class	Year-class strength index*		
	Bynum Reservoir	Lake Frances	Tiber Reservoir
1983	-	114	-
1984	-	37	91
1985	81	138	162
1986	28	153	154
1987	63	81	121
1988	38	128	105
1989	68	129	161
1990	298	134	135
1991	149	69	98
1992	17	32	68
1993	7	20	36
1994	125	204	40

* Index based on values averaging near 100.

Table 9. Relative weights of walleye from Region Four reservoirs.

Year	Relative Weights		
	Bynum Reservoir	Lake Frances	Tiber Reservoir
1991	87	86	92
1992	86	87	88
1993	94	89	86
1994	93	89	84
1995	95	87	87
1996	97	92	83
1997	91	87	90

East Fork Reservoir

Trap nets were set in mid-April within one week of ice-off. During 12 trap nights, 81 northern pike, 359 yellow perch and 679 white suckers were captured. An additional 19 white suckers were recaptured, which was less than 3% of the total catch. Northern pike averaged 3.35 lbs, yellow perch 0.23 lbs and white suckers 1.08 lbs (Table 10). Tag returns have been sparse from this water. Only 1 of 17 tags has been returned from northern pike tagged in 1995 and only 2 tags were returned by November from fish tagged in 1997. These tags were returned soon after trapping. However, 2 of the 17 northern pike tagged in 1995 were recaptured during 1997 trapping. These northern pike had grown from 20.0 to 28.8 inches and from 27.7 - 33.3 inches. Each fish had gained about 4 lbs in two years.

Shoreline seining surveys captured record numbers of yellow perch averaging 250 per haul that were less than 4 inches long (Figure 14, Table 11). Based on size structure, age 1 fish constituted 36% of the seined yellow perch with the remaining 64% young of the year (YOY). Such large numbers of Age 1 yellow perch had not been seen in the past (Hill et al. 1997 and Hill et al. 1996). Small numbers of white suckers were also captured and northern pike reproduction was documented (Table 11).

Table 10. Overnight trap net results in lakes and reservoirs in the Lewistown area during 1997.

Water name (Date surveyed)	Number of trap nights	Species[1]	Total # of fish	Length (in) Range	Length (in) (Mean)	Weight (lbs) Range	Weight (lbs) (Mean)	Condition Factor Range	Condition Factor (Mean)	Relative weight Range	Relative weight (Mean)
East Fork Spring Cr. (4/21-4/24)	12	NP	81	10.1-35.0	(22.1)	0.20-11.9	(3.35)	19.4-30.5	(24.5)	90.3-137.0	(108.8)
		YP[2]	359	7.0- 9.2	(7.8)	0.14-0.44	(0.23)	34.5-62.3	(47.2)	69.9-125.3	(94.4)
		WSU[2]	679	7.5-17.0	(13.8)	0.11-1.65	(1.08)	26.1-51.3	(40.5)	-	
		LNSU	3	14.8-16.4	(15.5)	1.11-1.30	(1.19)	29.5-34.2	(31.9)	-	
Petrolia (4/28-4/30)	8	WE	8	11.1-23.9	(14.0)	0.42-5.50	(1.32)	29.0-40.3	(32.8)	82.1- 99.8	(90.0)
		YP	1		(11.7)		(0.55)		(34.3)		(62.5)
		CARP	8	4.9- 6.1	(5.5)						

1:NP=northern pike; YP=yellow perch; WSU=white sucker; LNSu=longnose sucker; WE=walleye; 2: sub-sample of lengths and weights taken.

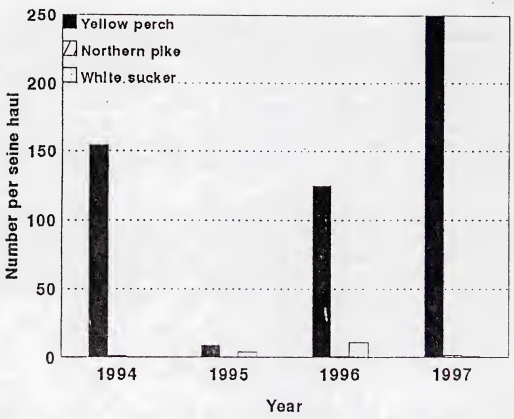

Figure 14. Forage fish trends from shoreline seining hauls taken in East Fork Reservoir 1994-97.

Fall gill netting results were similar to those seen in 1997. Yellow perch were captured at record levels and northern pike capture rate was slightly higher than seen in 1996 (Figure 15). Relative weights of northern pike and yellow perch declined from 1996 and were low for both species (Table 12 and Hill et al. 1997). Average northern pike total length decreased by about 4 inches while yellow perch total length decreased by 0.3 inches. White sucker size continued to increase from 1996.

Petrolia Reservoir

Dam repairs were completed on Petrolia Reservoir in 1997, allowing the reservoir to completely fill for the first time in several years. Water spilled for several weeks in the spring and water levels remained high throughout 1997. In September 1997, Petrolia Reservoir was about 3 feet below full pool. Petrolia was drawn down at least 15 feet in September 1996.

Eight trap nights caught 8 walleye and 1 yellow perch (Table 10). Trapping was probably initiated too late to capture many fish.

Twenty-one hundred spottail shiners were transferred to Petrolia Reservoir on 6/11/97. An additional 2000 were transferred in 1996. Only one adult spottail was captured during shoreline seining in 1997. Catch of YOY spottail shiners averaged 1.2 per haul, which was less than was found in 1996. Catch rates of yellow perch and walleye captured during seining also declined (Table 11, Figure 16).

Gill netting captured 31 walleye from 9.7 - 19.9 inches (Table 12). This was a dramatic drop in catch rate from 1997 (Figure 17). Average relative weight of walleye decreased from 95.0 to 94.0 and is slightly less than a suggested target range of 95 - 105 (Murphy et al. 1990). Catch rates of yellow perch were the highest ever documented. Average yellow perch total length decreased from 9.1 to 8.6 inches but relative weight increased from 95.2 to 106.8. Northern pike numbers were the highest seen in several years, and average size increased from 13.4 to 21.5 inches. White sucker numbers declined slightly. Nineteen carp from the huge 1996 year class were captured during gill netting and their average total length increased 6.5 inches since September 1997 (Table 12 and Hill et. al. 1997).

Table 11. Number of forage fish captured per pull during 1997 beach seining of large Lewistown area reservoirs.

Water	Date	Water temp(.F)	# of hauls	Species[1](average TL (inches)) YP-0	YP-1	WE	NP	LND	WSU	SSH	LCH
Petrolia	8/8/97	75	15	14.4	0.0	0.8	0.0	0.1	0.0	1.2	0.1
	& 8/13/97	70		(3.0)		(5.2)		(1.5)		1.9(1.5)	
East Fork[2]	8/7/97	72	8	159	91	-	0.5	-	0.2	-	-
				(2.1)	(3.1)	-	(8.0)	-	-	-	-

1:NP=northern pike; YP=yellow perch; WSU=white sucker; LND=longnose dace; SSH=spottail shiner; WE = walleye; LCH = lake chub; 2:Lengths subsampled in East Fork Reservoir.

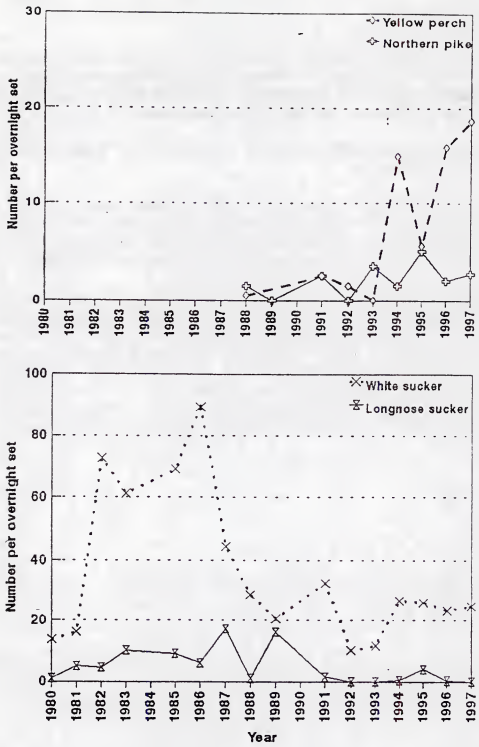

Figure 15. Trends in fish populations from East Fork Reservoir from fall gill nets (1980-1997).

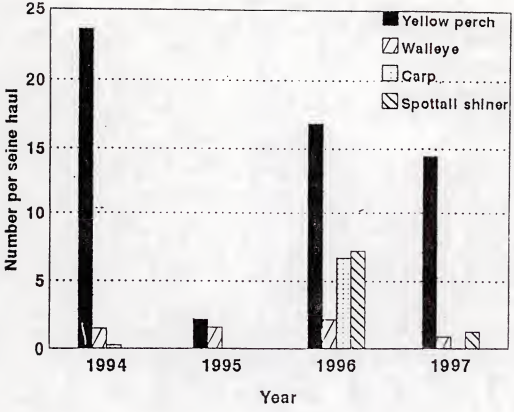

Figure 16. Forage fish trends from shoreline seining hauls taken in Petrolia Reservoir, 1994-1997.

Table 12. Overnight gill netting results in large lakes and reservoirs in north central Montana during 1997.

Water name (Date surveyed)	# of[1] nets	Mean hours fished/net	Species[2]	Total # of fish	Length (in) Range	Length (in) (Mean)	Weight (lbs) Range	Weight (lbs) (Mean)	Condition Factor Range	Condition Factor (Mean)	Relative weight Range	Relative weight (Mean)
East FK Spring (9/16/97)	1F,2S	20.3	NP	8	19.4-30.0	(22.9)	1.30-6.6	(2.64)	12.3-25.9	(19.9)	54.4-114	(88.2)
			YP	56	5.6-10.3	(7.5)	0.05-0.45	(0.17)	25.2-46.4	(36.4)	53.1-89.5	(73.6)
			LL	1	-	(17.7)	-	(2.57)	-	(46.3)	-	
			WSU	74	12.6-15.8	(14.1)	0.74-1.40	(1.03)	29.2-42.0	(36.8)	-	
Petrolia (9/8/97)	2F,2S	27.0	WE	9	9.7-11.9	(11.0)	0.29-0.64	(0.45)	30.1-38.0	(33.6)	85.6-106.6	(95.8)
			WE	16	12.8-15.8	(14.4)	0.68-1.46	(1.05)	27.9-41.5	(34.4)	75.0-111.7	(93.4)
			WE	6	17.8-19.9	(18.5)	2.09-2.65	(2.25)	33.6-37.5	(35.8)	86.1- 97.8	(92.8)
			WE(all)	31	9.7-19.9	(14.2)	0.29-2.65	(1.11)	27.9-41.5	(34.4)	75.0-111.7	(94.0)
			NP	16	17.9-25.5	(21.5)	1.10-4.23	(2.31)	18.9-27.5	(21.9)	84.8-122.7	(97.5)
			YP	49	5.7-12.5	(8.2)	0.10-1.20	(0.33)	42.7-97.2	(53.5)	80.4-208.8	(106.8)
			WSU	6	13.5-17.8	(16.1)	1.10-2.35	(1.85)	40.9-45.3	(43.2)	-	
			Carp	19	9.2-12.6	(11.3)	0.43-0.99	(0.72)	43.6-55.4	(49.3)	-	
			Carp	6	22.7-24.8	(23.6)	4.30-6.50	(5.38)	36.8-44.4	(40.8)	-	

[1] F= Floater and S= Sinker [2] NP=northern pike; YP=yellow perch; WSU=white sucker; LnSu=longnose sucker; WE=walleye; LL=brown trout

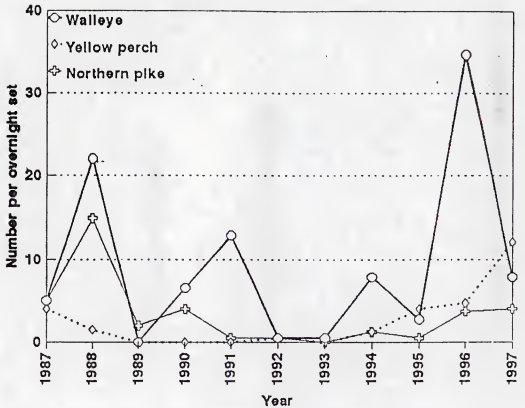

Figure 17. Trends in fish populations from Petrolia Reservoir from fall gill nets (1987-1997).

Other Lewistown Reservoirs

Several small reservoirs east of Lewistown were surveyed during 1997 (Table 13). Pertinent findings for each water are discussed below. Most reservoirs in the Lewistown area were full throughout 1997. Surveys found three reservoirs that have the potential to provide warmwater fisheries. All three are located on BLM land near the Musselshell Trail and include Bubs (see below), Whisker and Wolf Coulee Reservoirs. Bubs and Whisker Reservoirs have not been stocked by MFWP. Wolf Coulee was stocked before the dam washed out several years ago. The dam should be repaired by 1998. An additional reservoir (T16N R27E section 4) was surveyed and determined to be too shallow to overwinter fish. No fish were seen during visual reproductive surveys at Holland Reservoir and during 2 seine hauls at Catfish Reservoir.

Bubs- This is an old reservoir which has never been surveyed or stocked by MFWP. One seine haul captured 67 yellow perch and a gill net captured 26 yellow perch (Table 13). These yellow perch were illegally stocked and limit future management options. This reservoir had a maximum depth of 18 feet in September and much of the reservoir was 12 - 15 feet deep, giving it excellent potential to overwinter fish.

Dry Blood Reservoir- During the 1997 survey, largemouth bass up to 12.8 inches long and 0.5 pounds were captured. Hundreds of YOY largemouth bass were seined. We assume complete winter kill occurred during 1994-1995 since no evidence of largemouth bass were seen during a 1995 gill and trammel net survey (Hill et al. 1996). Hundreds of leeches were attached to the four salamanders taken in 1995, further indicating bass winter kill. The only fish stocked since that survey were 3000 1.8 inch largemouth bass stocked in 1995. Therefore, some largemouth bass may have grown over 10 inches in 2 - 3 growing seasons. The large numbers of largemouth bass from 2 - 8 inches indicate reproduction and recruitment have been very successful in this reservoir.

Jakes reservoir- Very few small yellow perch and one large white sucker were captured. Northern pike stocked in 1996 were not taken (Table 13).

Payola Reservoir-Yellow perch numbers were similar to those seen in 1994 (Hill et al. 1995) but average total length decreased from 9.1 to 8.6 inches. One 12.4 inch largemouth bass was taken as were 3 black bullheads. Black bullhead numbers decreased from 1994 when 13 were taken but average total length increased about 2.5 inches to 12.3 inches. Seine hauls indicated largemouth bass and yellow perch reproduction was excellent in 1997 (Table 13).

South Fork Blood Reservoir- This reservoir apparently has winter killed since it was last stocked in 1995, as no fish were captured (Table 13). About 1000 2-11 inch largemouth bass were transferred from Dry Blood to South Fork Blood Reservoir in August.

Table 13. Gill netting and seining results from small reservoirs in north central Montana during 1997.

Water name (Date surveyed)	# of[1] nets	Mean hours fished/net	Species[2]	Total # of fish	Length (in) Range	Length (in) (Mean)	Weight (lbs) Range	Weight (lbs) (Mean)	Condition Factor Range	Condition Factor (Mean)	Relative weight Range	Relative weight (Mean)
Bubs (9/25/97)	1S	22.5	YP (all)	26	5.1-14.5	(7.7)	0.04-1.31	(0.28)	24.0-52.8	(35.6)	51.9-116.3	(72.2)
			YP small	19	5.1- 7.3	(5.9)	0.04-0.11	(0.07)	24.0-52.8	(33.7)	51.9-116.3	(72.0)
			YP large	7	11.0-14.5	(12.7)	0.05-1.31	(0.86)	37.6-44.3	(40.7)	69.4- 79.1	(72.7)
(9/3/97)	1 seine		YP	67	3.0- 5.6	(3.6)						
Catfish (9/3/97)	2 seine (poor)		No Fish									
Dry Blood (7/23/97)	1S & 1S trammel	20.3	LMB	54	6.0-12.8	(9.2)	0.09-1.46	(0.52)	41.7-69.6	(58.2)	-	
	1 seine		LMB	9	2.1- 2.5	(2.3)						
(8/11/97)	8 seine[3]		LMB	650	2.2-11.0	(3.3)						
Jakes (7/7/97)	1S	23.0	YP	6	5.3- 6.0	(5.7)	0.04-0.07	(0.06)	26.9-32.4	(29.1)	58.7- 68.8	(62.5)
			WSU	1	-	(13.5)	-	(1.11)	-	(45.1)	-	
Payola (9/4/97)	1S	22.7	YP	70	6.1-12.1	(8.6)	0.09-0.96	(0.35)	36.0-58.8	(46.7)	75.6-109.5	(91.5)
			LMB	1	-	(12.4)	-	(0.98)	-	(51.4)	-	
			BBH	3	12.0-12.7	(12.3)	1.13-1.19	(1.17)	57.6-65.5	(62.8)	-	
	3 seine		LMB	85	1.7- 3.5	(2.2)						
			YP	87	2.0- 3.9	(3.4)						
South Fk Blood (7/23/97)	1S	20.5	No Fish									

[1]S= Sinker; [2] YP=yellow perch; WSU=white sucker;LMB=largemouth bass;BBH= black bullhead [3] Approximate numbers

GREAT FALLS AREA WATERS

Missouri River between Morony Dam and Marias River

The Portage Coulee section was electrofished on 8 and 9 September 1997, for a total of 8.2 hours. Water temperatures ranged from 65-68°F. Sixteen species were collected for length and weight measurements (Table 14). Common carp, smallmouth buffalo, longnose dace, spottail shiners, emerald shiners, flathead chub and mottled sculpins were observed but not captured. Up to fifty specimens for each species of all other non-game species were collected. Relative abundance is shown for game species and those non-game species where less than fifty were captured (Table 14). Shorthead redhorse suckers and goldeye were the most common non-game species observed during the electrofishing operation. Closer examination of small suckers found twenty-three to be mountain suckers in 1997. Catch statistics for various non-game species are presented in Table 14.

Walleye catch per unit effort (CPUE) increased to a high of 3.9 fish per hour (Table 15). Nine sauger were electrofished for a CPUE of 1.1 fish per hour. Catch rates for smallmouth bass declined to 8.8 fish per hour in 1997. Thirty-five percent of the 72 bass sampled were young-of-the-year compared to sixty-eight percent in 1996. Fewer smallmouth bass were available for stocking in 1997 reducing the plant by half of 10,000 fingerlings for the Missouri River between Morony Dam and Carter Ferry. This may account for the lower CPUE and lower percentage of young-of-the-year bass in the 1997 catch (Table 15).

Rainbow and brown trout numbers declined from the all-time highs seen in 1996. Thirty-one rainbow trout and 18 brown trout were captured for a CPUE of 3.89 and 2.2 fish per hour, respectively. Mountain whitefish catch rates declined to 0.7 fish per hour in 1997 (Table 15). Other game fish species collected include 3 northern pike and 3 channel catfish.

Habitat Protection

Private individuals or government entities that wish to construct projects that may alter streambeds or banks are required to obtain a permit. The 1975 Natural Streambed and Land Preservation Act (310) involves the private sector while the Stream Protection Act of 1963 (SPA) covers government agencies. Projects received during 1997 are documented in the Choteau, Lewistown and Great Falls offices. Site inspections were held on most of the projects received and recommendations were made or permits issued.

No significant water discharge permit applications or renewals were received and no significant pollution complaints were received during the report period.

Table 14. Catch statistics from electrofishing surveys of the Portage Coulee Section on the Missouri River, Montana, 8-9 September 1997.

Species	Number of fish	Length (inches) Mean	Length (inches) Range	Weight (pounds) Mean	Weight (pounds) Range	Mean condition factor
Freshwater drum	86	13.8	8.8-23.2	1.51	0.33- 6.60	46.62
Goldeye	183	12.9	11.8-15.5	0.74	0.50- 1.42	34.24
Rainbow trout	31	11.0	4.3-19.9	1.00	0.03- 2.22	34.41
Brown trout	18	16.8	8.7-25.5	1.92	0.20- 7.00	34.13
Mountain whitefish	6	8.7	5.8-15.2	0.47	0.07- 1.68	34.77
Walleye	32	15.2	10.7-29.2	1.20	0.36- 2.90	34.19
Sauger	9	15.6	13.7-18.6	1.17	0.70- 1.87	30.14
Smallmouth bass	72	7.5	3.4-13.4	0.47	0.02- 1.62	60.71
Mountain sucker	23	5.9	4.2- 8.3	0.09	0.02- 0.30	40.46
Shorthead redhorse	265	16.5	11.7-21.7	2.05	0.67- 4.13	41.76
Longnose sucker	86	8.4	3.3-19.8	0.49	0.02- 3.13	39.09
White sucker	28	7.8	5.3-16.5	0.37	0.05- 1.93	39.96
Stonecat	5	6.6	5.7- 7.9	0.11	0.09- 0.13	30.40
Northern pike	3	28.5	26.2-30.6	6.39	4.36- 7.80	26.92
Channel catfish	3	19.7	19.0-20.4	3.13	2.40- 3.85	40.56
River carpsucker	28	18.2	13.9-20.5	3.02	1.30- 4.10	49.57

Table 15. Comparison of catch per unit (CPUE) of game species from electrofishing surveys of the Portage Coulee section on the Missouri River, Montana, 1988-1997.

	Date							
	9/8-9/88	8/23-24/89	8/24&28/91	9/14/93	9/1-2/94	9/7-8/95	9/10&13/96	9/8-9/97
Species	CPUE - number of fish/hour (total number captured)							
Sauger	13.8 (94)	2.3 (15)	0.4 (3)	4.2 (11)	0.1 (1)	3.5 (19)	2.2 (15)	1.1 (9)
Walleye	2.1 (14)	0.2 (1)	0.1 (1)	2.3 (6)	0.4 (3)	3.5 (19)	3.5 (24)	3.9 (32)
Rainbow trout	1.2 (8)	0.5 (3)	0.3 (2)	2.7 (7)	4.8 (34)	3.3 (18)	8.7 (60)	3.8 (31)
Brown trout	2.4 (16)	0.5 (3)	0.1 (1)	3.8 (10)	2.9 (20)	1.9 (10)	5.9 (41)	2.2 (18)
Mountain whitefish	0.3 (2)	0.2 (1)	- (0)	0.4 (1)	3.4 (24)	6.9 (37)	3.9 (27)	0.7 (6)
Smallmouth bass	- (0)	- (0)	- (0)	0.4 (1)	0.3 (2)	2.0 (22)	13.0 (90)	8.8 (72)
Total effort (hours)	6.8	6.5	7.2	2.6	7.0	5.4	6.9	8.2

DISCUSSION AND RECOMMENDATIONS

Walleye numbers remain stable at Bynum Reservoir, providing a good fishery. The forage base is adequate with smaller size yellow perch increasing and crayfish remaining abundant. Spottail shiner, however, continue at low levels. Natural reproduction of walleye continues in limited numbers as this species has not been stocked since 1992. The population should be closely monitored and if necessary, supplemental stocking should commence. Additional yellow perch spawning structures should be installed as time permits and existing structures should be evaluated with scuba divers.

Northern pike in Lake Frances continue to occur in fairly large numbers and may be limiting recruitment of walleye into the fishery. A few small walleye were observed in anglers creels, indicating some recruitment is occurring. In an attempt to improve walleye numbers, a total of 100,000 walleye fingerlings were stocked June 18,1997. Little survival is expected due to very poor condition of the fish when stocked. On September 11, 1997, an additional 17,432 fingerlings were stocked and were in much better shape. Survival of any stocked walleye fingerlings is questionable due to limited recruitment of excellent numbers of walleye produced naturally in the lake. Anglers should continue to be encouraged to keep limits of small northern pike, thereby reducing overall numbers. Forage fish numbers decreased somewhat from previous years but yellow perch are still considered adequate. Crayfish are also abundant, although not as abundant as at Bynum Reservoir.

Previous reports discussed the overall forage problems in Tiber Reservoir, relating to stable but small body size of spottail shiner and less than desirable yellow perch numbers caused by fluctuating water levels. Over five million cisco fry were introduced in the reservoir in April/May 1997 to improve the forage base for walleye, northern pike and lake trout. The introduction appears to have been successful as determined by monitoring efforts conducted in September. Hydroacoustic surveys indicated the presence of large numbers of small fish below 20 meters. Trawl samples and vertical gill nets verified these fish to be cisco. Some utilization of cisco by walleye and burbot have been documented to date. Cisco should be stocked again in 1998 and monitoring efforts continued.

Tag losses on walleye was discussed in detail in this report last year (Hill, et al. 1997). The 1997 spring trapping data shows that jaw tag loss (1996 tagging year) is quite low for the first year following tagging, ranging from 0 percent at Bynum Reservoir to 5 percent at Tiber Reservoir. After two years (through spring 1998), jaw tag loss varies from 0 percent at Bynum to 13 percent at Tiber. For the 1997 tagging year, loss of jaw tags was zero for both Bynum and Tiber through spring 1998. Additional information was also obtained on T-tag and cinch-up tag loss. After one year following tagging, T-tag loss was 18 percent for fish tagged in 1997 at Bynum.. At Tiber Reservoir, first year loss of cinch-up tags (1996 tagging year) was 10 percent, increasing to 38 percent after two years (through spring 1998). For the 1997 tagging year, cinch-up tag loss was 29 percent through the first year following tagging. The above information is based on tag returns of fish caught in trap nets and further handled with dip nets. Some of the tag loss (particularly jaw tags) occurs because of the tags becoming entangled in the netting and pulling loose. Newman and Hoff (1998) reported similar findings in Wisconsin. Tag return data obtained during netting surveys is still the best information because anglers can't be relied on to observe whether or not a fish has lost a tag.

Monitoring of these three types of tags should continue during future surveys.

We should continue monitoring fish populations in East Fork Reservoir by trapping, tagging, seining and gill netting. This information will help determine if the fishery is being overharvested and to better understand the size structure of the northern pike and yellow perch populations.

Potential access conflicts on Petrolia have not been resolved; public access will continue in the near future but nothing has been decided regarding site maintenance responsibilities. Spottail shiners need to be planted again in Petrolia Reservoir. Walleye should continue to be stocked at rates seen during the past few years. The trapping operation should be intensified to get a better understanding of the yellow perch, walleye and northern pike size structure in Petrolia Reservoir.

Once Wolf Coulee fills, depth should be surveyed to determine fishery potential. Bubs, Wolf Coulee and Whisker Reservoirs need to be evaluated for stocking options and for access.

ACKNOWLEDGMENTS

The authors recognize the following individuals and organizations for assistance in this project; Kelly Smith, Jimmy Forrest, Steve Leathe, Troy Humphrey, Jim Peterson, Kenny Staigmiller, Jim Schultz, Mike Rhodes, Monte Reder, Mark Hamilton, Ray Ault, Orville O'Keith, Charlie Frey, Great Falls Walleye Unlimited, Bureau of Reclamation, Marias Management Committee, and Saskatchewan fisheries personnel.

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DATE: October 1998

PRINCIPAL FISH SPECIES INVOLVED: Walleye, northern pike, yellow perch, spottail shiner, largemouth bass, black bullhead.

CODE NUMBERS OF WATERS REFERRED TO IN REPORT:

14-7080 Bynum Reservoir
14-7440 Lake Frances
14-9240 Tiber Reservoir
16-4950 East Fork Spring Creek Reservoir
16-6070 Jakes Reservoir
16-8986 Wolf Coulee Reservoir
17-4864 Missouri River Sec. 07
18-7565 Dry Blood Reservoir
18-7389 Holland Reservoir
18-7395 Catfish Reservoir
18-8700 Payola Reservoir
18-8720 Petrolia Reservoir
18-9150 South Fork Blood Reservoir
20-7950 Pishkun Reservoir

Appendix I. Forage fish/reproduction beach seining survey results for several Region Four reservoirs during August, 1997.

Water	Date	Water temp(°F)	No.of Pulls	Number of fish/pull													
				YP	SS	WSu	Cray	WE	NP	Carp	Msc	Ling	LND	LC	ES	SB	FHC
Bynum Res.	8-20-97	67°	16	105.3	6.4	3.7	0.7	1.1									
LakeFrances	8-19-97	68°	18	70.5	29.5	2.4	0.8	1.1	2.2			0.1					
PishkunRes.	8-22-97	65°	15	25.3	0.3	22.1	1.7		0.1								
Tiber Res.																	
Dam	8-25-97	69°	17	201.2	82.3	15.4	0.8	2.0	1.3	1.6	0.9	0.1			0.9		
WCA	8-26-97	69°	18	29.6	109.6	6.5	0.7	2.5	0.5	31.4		0.1		0.1	3.6	0.8	
BT	8-27-97	69°	17	44.8	206.1	3.7	2.3	1.8	0.8	3.1	0.5	0.1			0.4		
Devon	8-28-97	72°	16	16.2	185.4	1.1	1.1	8.7		15.3	0.3		0.1	1.1	6.8		0.1
Tiber combined			68	73.2	144.7	6.8	1.2	3.7	0.7	13.1	0.4	Tr.	Tr.	0.3	2.9	0.2	Tr.

Appendix II. Gill net summaries by area of Tiber Reservoir, 1997.

Area (date)	No. of nets	Hours fished	Species	No. of fish	Length range	(avg)	Weight range	(avg)
WCA area (9/3/97)	11	18.75	WE	39	6.3-12.9	(9.8)	0.09- 0.70	(0.34)
				31	13.0-15.3	(14.2)	0.74- 1.36	(0.96)
				8	16.0-19.0	(17.3)	1.44- 2.02	(1.77)
				1		(20.0)		(2.50)
			NP	3	10.8-11.5	(11.1)	0.32- 0.38	(0.34)
				1		(16.5)		(1.14)
			YP	7	20.2-25.6	(22.0)	2.32- 4.74	(2.96)
				155	5.5- 8.9	(7.0)	0.07- 0.37	(0.18)
				39	9.0-10.8	(9.6)	0.34- 0.66	(0.44)
				5	11.4-13.2	(12.1)	0.70- 1.10	(0.86)
			WSu	16	6.4-12.8	(8.7)	0.12- 0.94	(0.34)
				29	15.4-18.8	(17.0)	1.18- 2.96	(2.12)
			Carp	23	4.0- 5.5	(4.4)	0.04- 0.12	(0.06)
				1		(28.0)		(12.30)
			Rb	3	13.4-15.0	(14.4)	0.92- 1.28	(1.14)
				7	18.1-22.1	(19.8)	1.95- 3.19	(2.48)
BT area (9/4-5/97)	6	17.00	WE	5	7.5-12.4	(11.2)	0.12- 0.62	(0.47)
				5	13.3-14.6	(13.8)	0.72- 0.94	(0.80)
				1		(16.3)		(1.46)
			NP	1		(9.7)		(0.18)
				1		(21.7)		(2.62)
			YP	16	5.5- 8.7	(7.1)	0.08- 0.36	(0.19)
				11	9.1-10.5	(9.8)	0.35- 0.60	(0.47)
			LnSu	6	10.2-16.7	(14.2)	0.43- 1.88	(1.25)
			WSu	1		(10.2)		(0.44)
				1		(18.0)		(2.53)
			Ling	1		(14.1)		(0.68)
Dam area (9/4/97)	6	17.00	WE	5	7.2-10.9	(8.1)	0.08- 0.38	(0.16)
				4	13.4-14.9	(14.2)	0.76- 1.08	(0.96)
				4	16.1-17.3	(16.8)	1.30- 1.73	(1.51)
			NP	1		(10.4)		(0.27)
				2	21.0-21.7	(21.4)	1.97- 2.13	(2.05)
			YP	12	5.1- 8.0	(6.4)	0.07- 0.28	(0.12)
			Rb	1		(19.3)		(2.37)
			WSu	2	11.9-12.8	(12.4)	0.76- 1.02	(0.89)
				5	14.8-17.8	(16.6)	1.42- 3.00	(2.16)
			LnSu	1		(16.9)		(1.89)
			Carp	3	3.8- 4.3	(4.1)	0.03- 0.04	(0.03)
				1		(27.2)		(12.40)
Devon area (9/5/97)	6	15.70	WE	4	11.9-12.7	(12.4)	0.52- 0.64	(0.58)
				2	13.9-14.9	(14.4)	0.74- 1.00	(0.87)
			NP	1		(12.6)		(0.44)
				1		(19.5)		(1.88)
			YP	1		(9.3)		(0.38)
			WSu	1		(11.2)		(0.60)
				12	13.3-17.9	(16.0)	1.00- 2.69	(1.95)
			LnSu	5	15.2-19.9	(17.1)	1.30- 3.06	(2.12)
			Carp	1		(4.3)		(0.05)
				1		(9.5)		(0.49)
				1		(26.1)		(8.80)

Appendix III. Age composition of walleye captured in fall gill nets on Bynum Reservoir, 1991-1997.

Year	No. of spines	No. of nets	Number of fish per age per gill net set										
			1	2	3	4	5	6	7	8	9	10	Totals
1991	14	4	1.00	–	0.50	1.75	–	1.25					4.50
1992	23	4		1.50	3.50	0.50	0.50	0.50					6.50
1993	45	4		4.00	7.50	0.50	1.18	–	0.33	0.25			13.76
1994	26	4		0.50	1.38	4.13	0.25	0.25	–		0.25		6.76
1995	94	10	3.10	0.10	0.31	3.69	1.97	0.53	–	0.10			9.80
1996	60	10	0.80	1.10	0.30	0.30	1.60	5.00	–	–	0.30		9.40
1997	71	10	0.70	1.90	1.00	–	–	1.58	3.96	0.46	0.10	0.20	9.90
Mean catch for each age class			0.80	1.30	2.07	1.55	0.79	1.30	0.61	0.12	0.09	0.03	8.66
Avg % contribution by each age class			.092	.150	.239	.179	.091	.150	.070	.014	.010	.003	.998

Appendix IV. Age composition of walleye captured in fall gill nets in Lake Frances, 1991-1997.

Year	No. of spines	No. of nets	Number of fish per age per gill net set												Totals
			1	2	3	4	5	6	7	8	9	10	11	12+	
1991	41	6	0.67	0.83	2.00	1.50	0.83	0.50		0.33	0.17				6.83
1992	24	12		0.33	0.94	0.39	-	0.42	0.08						2.16
1993	45	10		0.70	1.30	0.70	0.80	0.10	0.30	0.30	0.20	0.30			5.40
1994	54	10		0.20	0.68	1.44	1.09	0.41	0.30	0.61	0.78	-	0.10	0.20	5.81
1995	57	20	0.65	0.05	0.40	0.40	0.25	0.45	0.20	-	0.25	0.10	0.05	0.05	2.85
1996	73	20	0.35	0.90	0.25	0.25	0.42	0.60	0.60	0.26	0.06	0.43	0.06	0.10	4.28
1997	58	20	0.10	0.45	2.25	0.21	0.31	0.18	0.37	0.18	0.10	-	0.15		4.12
Mean catch for each age class			0.25	0.49	1.12	0.70	0.50	0.38	0.26	0.24	0.22	0.12	0.05	0.05	4.38
Average % contribution by ea. age class			.057	.112	.263	.160	.114	.087	.059	.055	.050	.027	.011	.011	1.006

Appendix V. Age composition of walleye captured in fall gill nets on Tiber Reservoir, 1991-1997.

Year	No. of spines	No. of nets	Number of fish per age per gill net set													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
1991	109	24	0.91	4.18	2.12	1.44	1.05	0.42	0.36	0.15	0.05	0.04	-	-	-	0.04	10.76
1992	102	25		1.70	3.22	1.14	0.93	0.69	0.60	-	0.04						8.32
1993	92	25	0.28	0.59	2.80	0.72	0.68	0.44	0.33	0.13							5.97
1994	66	25		0.38	1.65	0.37	0.12	0.13	-	0.09	0.05	0.04	0.04	0.04			2.91
1995	97	28	0.18	0.48	1.58	2.13	0.92	0.23	0.26	0.08	0.04						5.90
1996	65	27	0.22	0.15	0.51	0.61	0.66	0.11	0.15	0.11	-	-	-	-	-	0.04	2.56
1997	86	29	0.46	0.75	0.99	0.56	0.57	0.18	0.16	0.07	-	0.03					3.77
Mean catch for each age class			0.29	1.18	1.84	1.00	0.70	0.31	0.27	0.09	0.03	0.02	0.01	0.01	-	0.01	5.76
Avg % contribution by ea. age class			.050	.205	.319	.174	.122	.054	.047	.016	.005	.003	.002	.002	-	.002	1.001